Remarks/Arguments:

Claims 1-8 are pending. With this amendment, claims 1, 2, 7 and 8 are amended. Claims 1 and 2 have been amended to include the phrase "wherein one component of the processor is a bed of reforming catalyst that reforms fuel thereby producing reformate having a concentration of hydrogen." Support for this amendment can be found throughout the specification, particularly at page 1, lines 26-28; page 3, lines 1 and 2; page 3, lines 23 and 24; and page 5, line 22. Claims 1 and 2 have been further amended to replace the phrase "a reforming catalyst" with the phrase "the bed of reforming catalyst," and to replace the phrase "hydrogen concentration in dry reformate" with the phrase "hydrogen concentration (as measured in dry reformate)." Claim 7 has been amended to replace the phrase "catalyst bed temperature" with the phrase "the temperature of the bed reforming catalyst." Claim 8 has been amended to replace the phrase "one or more of the reactants" with the phrase "the fuel, air, or steam." These are clarifying amendments and do not add new matter.

I. Summary of the Invention

The present invention is directed toward a process for the regeneration of reforming catalysts, and in particular, to regeneration of a catalytic fuel processor while the processor is simultaneously supplying hydrogen to a fuel cell. The catalytic fuel processor of the present invention has a bed of reforming catalyst. To regenerate the catalytic fuel processor, the bed of reforming catalyst reforms a fuel to produce a reformate having a concentration of hydrogen. Regeneration occurs through manipulation of certain parameters. For example, regeneration is effected by varying the temperature of the catalyst bed, modulating the air and/or steam feed rate, modulating the feed-rate of the fuel, or by adding an oxygenate to the feed.

II. Discussion of Cited References

Cimini *et al.* is directed toward an integration of steam reforming unit with a cogeneration power plant. With reference to FIG. 1, Cimini *et al.* discloses a steam reforming apparatus wherein fuel and steam 1 are supplied to a reformer reactor 2 having a bed of fluidized, solid, particulate reforming catalyst (not shown). When the reforming catalyst needs regeneration, spent catalyst is transported through conduit 4 to catalyst combustion regenerator 5. Diverted compressed air 16 from the power plant is combined with fuel stream 7 in catalyst combustion regenerator 5 to remove fines from the catalyst. (See Col. 6, lines 44-

49). The regenerated catalyst is transported via conduit 6 back to reforming catalyst 2. Therefore, steam reforming takes place in the first bed and catalytic combustion regeneration takes place in the second bed.

Autenrieth *et al.* is directed toward a process for operating a methanol reforming system. Autenrieth *et al.* relates to the steam reforming of methanol (see Abstract) where the reforming reaction is periodically interrupted for reactivation of the methanol reforming catalyst. Col. 2 lines 37-43 state, "In this process, the reforming reaction operation is periodically interrupted for catalyst reactivation phases during which the methanol reforming catalyst, whose catalytic activity decreases during the reformation to reaction operation, is treated in a regenerating manner."

Supp *et al.* is directed toward a process of producing a synthesis gas for methanol synthesis. Col. 1, lines 36 state that the reforming reaction [for methanol synthesis] for the automatic catalytic reaction is fed with a high-hydrogen gas suitable for methanol synthesis. Therefore, Supp *et al.* teaches that hydrogen produced by the dehydrogenation of isobutane can be supplied to the reforming reaction (see apparatus 21 and line 5 of FIG. 1, Col. 2, lines 60-64) and that methyl tert butyl ether is the product that results from the dehydrogenation of isobutane. (See Apparatus 23 in FIG. 1 and Col. 2, lines 1-7).

III. The Office Action

A. Definiteness of the invention under § 112

Claims 1-8 stand rejected under 35 U.S.C. § 112, second paragraph, as indefinite for failing to particularly point out and distinctly claim the subject matter which applicants regard as their invention. The applicants have addressed each particular rejection in accordance with the numbered paragraphs in the Office Action.

6. Claims 1 and 2 now recite "the bed of reforming catalyst" instead of using the phrase "a reforming catalyst." The applicants submit that the amended language clarifies the applicants' invention.

7. The applicants submit that currently amended claims 1 and 2, reciting the limitation of "the hydrogen concentration," have proper antecedent basis.

8. Claims 1 and 2 have been amended to clarify the language relating to the hydrogen concentration. The applicants point out that the specification at page 5, lines 27-29, provide support for the limitation that the hydrogen concentration is maintained above 25%. The hydrogen concentration, as indicated, is measured after the reformate has been dried.

9. The applicants submit that currently amended claims 1 and 2 reciting the limitation of "the bed of reforming catalyst," have proper antecedent basis.

10. The applicants submit that currently amended claim 8, reciting the limitation of "the fuel, air or steam," has proper antecedent basis. The fuel, air, and steam are equivalent to "the reactant feeds" as previously recited in claim 8.

In view of the above amendments, the applicants respectfully submit that the pending claims clearly point out that which the applicants regard as their invention.

B. Lack of Anticipation

The Office Action rejects claims 1-4 and 7-8 under 35 U.S.C. § 102(b) as being anticipated by Cimini *et al.* (U.S. Patent No. 5,624,964). In view of the current amendments to the claims, the applicants submit that the Office Action rejection is moot and respectfully request reconsideration.

As discussed above, Cimini *et al.* is directed at removing spent catalyst from the reformer reactor 2 and regenerating the catalyst in a separate catalyst combustion chamber 5, before return to the reformer reactor 2. (See Col. 2, lines 20-22) Cimini *et al.* discloses that the reforming catalyst is regenerated in the catalyst combustion chamber 5 (see col. 2, lines 4-10), but that hydrogen is not produced in the catalyst combustion chamber 5. Cimini *et al.* does not suggest that a catalytic fuel processor can be regenerated or that its deactivation can be retarded by a method wherein fuel, air and steam and passed through a bed of reforming catalyst, while hydrogen is supplied to a fuel cell. In comparison, amended claims 1 and 2 in each reforming step, recite that one or more of four possible regeneration steps are effected to the same bed "while the processor is being used to supply hydrogen to a fuel cell." See claims 1 and 2, lines 3 and 4. For example, during the "heating the bed of reforming catalyst by an external heat source" process, this regenerative heating process occurs within the same "bed of reforming catalyst" through which fuel, air, and steam is being passed to produce reformate.

As a result, regeneration of the catalyst and hydrogen production occur in the same bed of reforming catalyst at the same time.

The Office Action rejects claims 1-5 and 8 under 35 U.S.C. § 102(e) as being anticipated by Autenrieth *et al.* (EP 884 271). In view of the current amendments to the claims, the applicants submit that the rejection is moot and respectfully request reconsideration.

As discussed above, Autenrieth *et al.* teaches the reformation of methanol and the periodic interruption of the process in order to regenerate the methanol catalyst reformer. Particularly, Autenrieth *et al.* discloses "the reforming reaction mode is interrupted periodically for catalyst reactivation phases." (See Abstract). In another method, Autenrieth *et al.* teaches the reforming process continues but "the load is reduced and/or the temperature is higher" (Col. 2, lines 54-55). The teaching is that "the lower the load is set in the catalyst reactivation phases, the higher the activity-regenerating effect" (Col. 3, lines 58-60). Specifically, Autenrieth *et al.* states "the load selected from the reactivation phases amounts to between 0% and approximately 50%." (Col. 3, lines 56-57). Therefore, Autenrieth *et al.* does not disclose a method wherein air is *continually* passed over a bed of reforming catalyst.

By contrast, amended claims 1 and 2 require "continuing to pass ... air ... through the bed of reforming catalyst to produce reformate" and one or more of four regeneration steps to occur while "the processor is being used to supply hydrogen to a fuel cell." The claims require that the reactivation methods do not substantially interrupt hydrogen production.

C. Non-obviousness

The Office Action rejects claims 5 and 6 under 35 U.S.C. § 103(a) as being unpatentable over Cimini *et al.* in view of Supp *et al.* The Office Action also rejects claim 6 under 35 U.S.C. § 103(a) as being unpatentable over Autenrieth *et al.* in view of Supp *et al.*

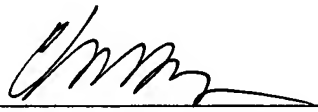
The Office Action states that "Supp *et al.* teaches a reforming reactor wherein high-hydrogen exhaust gas MTBE (methyl tert butyl ether) is supplied at least in part to the reforming reaction." The applicants respectfully disagree. As discussed above, Supp *et al.* teaches supplying hydrogen gas to a reforming reaction to form MTBE. This is *opposite* to the present invention which discloses supplying MTBE as an oxygenate to a reforming reaction to form hydrogen. The applicants therefore submit that the Office Action incorrectly interpreted

the teaching of Supp *et al.* and claims 5 and 6 are not obvious under Cimini e*t al.* and Autenrieth *et al.* in view of Supp *et al.*

IV. Conclusion

The applicants submit that in view of the claim amendments, the Office Action rejections are now moot. The amended claims recite regenerating a bed of reforming catalyst, which is part of a catalytic fuel processor. Regeneration occurs without interrupting the catalytic fuel processor and in the bed of reforming catalyst. Cimini *et al.* removes part of the bed of reforming catalyst from the fuel processor in order to reform the catalyst and Autenrieth *et al.* interrupts the catalytic fuel processor during regeneration of the bed of reforming catalyst. Finally, Supp *et al.* supplies hydrogen to a catalyst to produce MTBE whereas the present invention uses MTBE to from hydrogen. The combination of Cimini e*t al.* and Autenrieth *et al.* in view of Supp *et al.* would not result in the applicants' invention. Therefore, the applicants submit that amended claims 1-8 are neither anticipated nor rendered obvious by the cited references. Reconsideration is respectfully requested.

Respectfully submitted,



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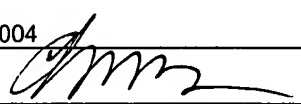

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